



# National Transportation Safety Board Aviation Accident Final Report

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<b>Location:</b>	Garden Valley, ID	<b>Accident Number:</b>	WPR13LA304
<b>Date &amp; Time:</b>	07/02/2013, 0800 MDT	<b>Registration:</b>	N39796
<b>Aircraft:</b>	DORMAN BAKENG	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Loss of engine power (total)	<b>Injuries:</b>	2 None
<b>Flight Conducted Under:</b>	Part 91: General Aviation - Personal		

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## Analysis

In the days just preceding the accident, the owner-pilot made several uneventful flights in the experimental amateur-built airplane, which was equipped with an aircraft engine and an automotive performance/racing oil cooler. On the morning of the accident, the owner's brother joined him at a remote turf airstrip in mountainous terrain to conduct a flight. The brother, who was also a pilot, took the aft cockpit seat, which was the primary pilot position in the airplane. The owner took the forward cockpit seat. The brother conducted the engine start, taxi-out, run-up, and takeoff, which were all normal. During the climbout, the owner realized that the airplane was not performing as it should, and, when he asked his brother about it, his brother reported that the engine was losing power. The owner took control of the airplane and began a turnback to the airport, and the engine lost total power shortly thereafter. An attempt to restart the engine was unsuccessful, and the airplane landed short of the runway.

Examination of the airport revealed an oil spray trail on the turf that began at the parking location and extended along the taxi route and through the takeoff path. Postaccident examination of the airplane revealed a significant oil streak on the exterior side of the airplane that emanated from the oil cooler. The engine was also devoid of oil. Detailed examination of the oil cooler revealed deformation of its containment frame and damage to some of the unit's oil tubes, which included separation of the cooling fins from the tubes and several holes in the tubes that permitted oil to escape the cooler. The damage signatures were not consistent with preaccident or postaccident impact or other structural deformation damage. The damage signatures were somewhat, but not completely, consistent with an internal overpressure of the oil cooler; however, the reasons for the internal overpressure could not be determined during postaccident examination.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A mechanical failure of the oil cooler, which resulted in a complete loss of oil and engine

power.

## Findings

Aircraft	Cooler - Failure (Cause) Oil - Fluid level (Cause) Recip eng oil sys - Damaged/degraded (Cause)
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## Factual Information

### HISTORY OF FLIGHT

On July 2, 2013, about 0800 mountain daylight time, an experimental amateur-built Bakeng Deuce airplane, N39796, was substantially damaged when it impacted vegetation and terrain near Garden Valley airport (U88), Garden Valley, Idaho, following a complete loss of engine power shortly after takeoff. The owner/pilot and his passenger were not injured. The personal flight was conducted under the provisions of Title 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed, and no flight plan was filed for the flight.

According to the owner-pilot, he based the airplane at Salt Lake City International airport (SLC), and had flown to U88 several times previously. On the accident trip, he originally left SLC for U88 on Saturday, June 29, stopped once for fuel, and landed at U88 later that same day. On Sunday June 30 he flew to another airport in Idaho, where he and the airplane remained overnight, before returning to U88 on Monday morning. Later that day, he made an out and back flight from U88 to obtain fuel. All flights were uneventful, and during preflight inspections, the engine oil quantity remained at its normal value.

On the morning of the accident, the owner's brother, who was also a pilot, joined him for a planned flight. The preflight inspection was normal. The airplane was equipped with dual flight and engine controls. The brother took the rear cockpit, which was the primary pilot position for the airplane. The brother conducted the engine start, taxi out, and runup; all were normal. The brother performed the takeoff from runway 28. When the airplane was on the crosswind leg, the owner queried his brother why they weren't climbing as well as he expected, and the brother responded that he was "losing rpms." The owner took control of the airplane, and turned back towards the airport. When the airplane was about 750 feet above the ground, the engine ceased operating. Since the engine could not be started from the front seat, the owner asked the brother to attempt a restart, but attempts were unsuccessful. The owner then attempted to land the airplane on runway 10 (opposite direction of the takeoff), but the airplane struck vegetation and the ground short of the runway. It came to rest upright, about 30 feet short of the runway threshold.

### PERSONNEL INFORMATION

#### Front Cockpit Owner-Pilot

Federal Aviation Administration (FAA) records indicated that the owner-pilot held a private pilot certificate, with a single-engine airplane rating. The certificate was issued in February 2010. The owner's most recent flight review was completed, and his most recent FAA third-class medical certificate was issued, in May 2012. The owner reported that he had a total flight experience of about 486 hours, including about 69 hours in the accident airplane make and model.

#### Aft Cockpit Pilot

According to information provided by the owner, his brother (the takeoff pilot) held a private pilot certificate, with a single-engine airplane rating. His most recent flight review was

completed, and his most recent FAA third-class medical certificate was issued, in May 2012. The owner reported that the takeoff pilot had a total flight experience of about 133 hours, including about 44 hours in the accident airplane make and model.

#### AIRCRAFT INFORMATION

According to FAA records, the airplane was manufactured in 1997. Neither the current owner nor his brother was the builder of the airplane; the current owner had purchased the airplane about 1 year prior to the accident. The airplane was of the high parasol-wing taildragger configuration, with tandem open cockpits.

The airplane was equipped with a Lycoming O-320-B2D engine, serial number L-21662-27A, and a fixed-pitch two blade propeller. The engine utilized a pressure-type wet sump lubrication system. Oil sump capacity was 8 quarts, and minimum engine operating oil quantity was 2 quarts. The owner reported that the sump contained about 5.5 quarts at the time of his pre-flight inspection.

Normal operating oil pressure range was 60 to 90 psi. The engine was equipped with an oil pressure relief valve to maintain oil pressure within the manufacturer-specified limits. The aft cockpit was equipped with an oil temperature and pressure gauge. The investigation did not determine whether oil and temperature information was presented in the forward cockpit.

According to information provided by the owner, the most recent annual condition inspection was completed on June 28, 2013. The maintenance entry for that inspection reported the following times: "Hobbs 395.4," "TTE 1598.1," "TSMOH 407.9," and "TTP 006.7." The engine had accumulated about 4 hours since its most recent inspection.

#### METEOROLOGICAL INFORMATION

The owner reported that the conditions at U88 included clear skies, a temperature of 75 degrees F (24 degrees C) and no wind.

#### AIRPORT INFORMATION

According to FAA information, the runway at U88 was turf, with a length of 3,850 feet, and an elevation of 3,177 feet.

#### WRECKAGE AND IMPACT INFORMATION

Post accident examination by the owner and an inspector from the FAA revealed an oil streak on the left side of the airplane that extended aft from the cowling. Examination of the airport revealed an oil spray trail on the turf ground surfaces along the taxi-out, run-up, and takeoff path. Examination of the de-cowled engine revealed that no oil remained in the engine, and that the oil streak had emanated from an undetermined location near or on the aft face of the oil cooler, which was mounted just forward of the firewall.

Detailed examination of the oil cooler fluid lines, airbox, and mounting did not reveal any abnormalities, indications of distress or distortion, or failures. Removal of the cover of the

airbox revealed that some of the oil cooler tubes and fins were deformed. The cooler was removed and shipped to the NTSB Material Laboratory for detailed examination.

## ADDITIONAL INFORMATION

### Oil Cooler

The oil cooler was installed in an aluminum airbox that was mounted just forward of the lower left portion of the firewall. A scot tube routed ram air into the airbox to effect cooling of the oil.

The oil cooler was an Earls Performance brand Model 21608 automotive performance/racing unit, constructed of aluminum. According to information provided by the manufacturer, each unit was pressure-tested to 175 psi. The time in service of the oil cooler was not determined.

The cooler configuration was similar to typical aircraft engine oil coolers. The cooler had an input and output plenum, each with a threaded fitting for its respective oil line. The two plenums were on opposite ends of the unit, and connected by 16 flat tubes that were perpendicular to the plenums, and parallel to one another. The tubes transported oil from the input plenum to the output plenum on the other side of the unit. The 16 tubes were interconnected via 15 rows of fins, which transferred the heat from the oil to the ram air passing through the cooler.

As installed in the airplane, the cooler was oriented so that the two plenums were at the top and bottom, and extended laterally. The tubes were oriented near-vertically, and for the investigation, were numbered from 1 to 16, inboard to outboard. The inlet and outlet fittings were located on the inboard side of the unit. A riveted set of four aluminum caps formed a structural frame for the cooler. The inboard and outboard caps were captive between the top and bottom caps; each corner joint was attached by two rivets. One fitting was wrapped with red tape as a marker for the investigation. The fitting with the red marker tape was the lower (or bottom) fitting. It was not determined whether this was the input or output line fitting.

Laboratory examination of the oil cooler did not reveal any residue or staining from oil leakage on any of its surfaces, with the exception of some dirt deposits around the fittings. Overall the oil cooler had a clean appearance. No evidence of impact or other contact damage was observed on any part of the oil cooler.

The oil cooler exhibited some plastic deformation, particularly between tubes 5 to 8, and tubes 12 to 13. The area of deformation bounded by tubes 5 to 8 was visible on the forward and aft faces of the cooler, while the deformation between tubes 12 and 13 was only visible on the aft face. The deformation was consistent with loading in the inboard-outboard direction, perpendicular to the tubes. The deformation of the tubes caused portions of the cooling fins to separate from the tubes, breaking the brazed connections between the fins and tubes. Between tubes 6 and 7, some areas where the fins were separated from the tubes resulted in small holes in those tubes.

The eight rivets in the four cap corner joints exhibited varying degrees of pull-through, consistent with tensile overload. One rivet was completely pulled through, six were partially pulled through, and one was only slightly deformed. The direction of the loading was inboard-outboard, perpendicular to the tubes.

The tube and frame damage was not consistent with any pre- or post-impact damage or

structural deformation, and the surrounding airbox was intact. The tube and frame damage was somewhat consistent with a cooler internal overpressure condition. The investigation did determine the timing or failure mechanism for the cooler damage. The investigation did not examine test the oil pressure relief valve.

## History of Flight

<b>Enroute-climb to cruise</b>	Powerplant sys/comp malf/fail Loss of engine power (total) (Defining event) Off-field or emergency landing
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## Pilot Information

<b>Certificate:</b>	Private	<b>Age:</b>	57
<b>Airplane Rating(s):</b>	Single-engine Land	<b>Seat Occupied:</b>	Front
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	
<b>Instrument Rating(s):</b>	None	<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 3 With Waivers/Limitations	<b>Last Medical Exam:</b>	05/04/2012
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	05/23/2012
<b>Flight Time:</b>	486 hours (Total, all aircraft), 69 hours (Total, this make and model), 486 hours (Pilot In Command, all aircraft), 10 hours (Last 90 days, all aircraft), 8 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

## Pilot Information

<b>Certificate:</b>	Private	<b>Age:</b>	0
<b>Airplane Rating(s):</b>	Single-engine Land	<b>Seat Occupied:</b>	Rear
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	
<b>Instrument Rating(s):</b>	None	<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 3 With Waivers/Limitations	<b>Last Medical Exam:</b>	05/30/2012
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>	133 hours (Total, all aircraft), 44 hours (Total, this make and model), 80 hours (Pilot In Command, all aircraft), 4 hours (Last 90 days, all aircraft)		

## Aircraft and Owner/Operator Information

Aircraft Manufacturer:	DORMAN	Registration:	N39796
Model/Series:	BAKENG Deuce	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	Yes
Airworthiness Certificate:	Experimental	Serial Number:	235
Landing Gear Type:	Tailwheel	Seats:	2
Date/Type of Last Inspection:	06/28/2013, Conditional	Certified Max Gross Wt.:	
Time Since Last Inspection:	4 Hours	Engines:	1 Reciprocating
Airframe Total Time:		Engine Manufacturer:	Lycoming
ELT:	Installed, activated, did not aid in locating accident	Engine Model/Series:	O-320-B2D
Registered Owner:	On file	Rated Power:	160 hp
Operator:	On file	Air Carrier Operating Certificate:	None

## Meteorological Information and Flight Plan

Observation Facility, Elevation:		Observation Time:	
Distance from Accident Site:		Condition of Light:	Day
Direction from Accident Site:		Conditions at Accident Site:	Visual Conditions
Lowest Cloud Condition:	Clear	Temperature/Dew Point:	24° C
Lowest Ceiling:	None	Visibility	20 Miles
Wind Speed/Gusts, Direction:	Calm	Visibility (RVR):	
Altimeter Setting:		Visibility (RVV):	
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Garden Valley, ID (U88)	Type of Flight Plan Filed:	None
Destination:	Garden Valley, ID (U88)	Type of Clearance:	None
Departure Time:	0800 MDT	Type of Airspace:	

## Airport Information

Airport:	Garden Valley (U88)	Runway Surface Type:	
Airport Elevation:	3177 ft	Runway Surface Condition:	Rough; Vegetation
Runway Used:	N/A	IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	Forced Landing

## Wreckage and Impact Information

Crew Injuries:	2 None	Aircraft Damage:	Substantial
Passenger Injuries:	N/A	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	2 None		

## Administrative Information

**Investigator In Charge (IIC):** Michael C Huhn **Adopted Date:** 08/25/2015

**Additional Participating Persons:** Michael Misnick; FAA FSDO; Boise, ID

**Publish Date:** 08/25/2015

**Note:** The NTSB did not travel to the scene of this accident.

**Investigation Docket:** <http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=87365>

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